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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/932,578	08/17/2001	Blake Lewis	5693P275X	5197
48102 7590 04/10/2008 NETWORK APPLIANCE/BLAKELY 1279 OAKMEAD PARKWAY SUNNYVALE, CA 94085-4040			EXAMINER LE, MIRANDA	
			ART UNIT 2167	PAPER NUMBER
			MAIL DATE 04/10/2008	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of Allowability

Application No.

09/932,578

Examiner

MIRANDA LE

Applicant(s)

LEWIS ET AL.

Art Unit

2167

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to a telephonic interview with Ms. Sheryl Sue Holloway (Reg. No. 37,850) on 03/21/08.
2. ☒ The allowed claim(s) is/are 25,27,30,32-35,40,42,43,45 and 51-53, now renumbered as 1-14.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material

5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

/Miranda Le/
Primary Examiner, Art Unit 2167

DETAILED ACTION

1. This communication is responsive to Amendments filed on 10/18/2007 and 02/05/08.

As a result of the amendment, claims 25, 32, 35, 43, 51 have been amended; claims 26, 44, 47, 49-50 have been cancelled. Claims 25, 27-35, 40-43, 45-46, 48, 51-55 are pending in the application.

Terminal Disclaimer

2. The terminal disclaimer filed on 01/17/2006 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of any patent grant on Application Number 09/462,061 has been reviewed and is accepted. The terminal disclaimer has been recorded.

EXAMINER'S AMENDMENT

3. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Applicant's representative, Ms. Sheryl Sue Holloway (Reg. # 37,850), on March 21, 2008.

The application has been amended as follows:

AMENDMENT TO THE TITLE

WRITE ALLOCATION BASED ON STORAGE SYSTEM MAP AND SNAPSHOT

AMENDMENTS TO THE CLAIMS:

- **Cancel claims 28, 29, 31**
- **Claim 25 has been amended as:**

A method comprising:

maintaining an active map of information indicating in-use blocks and free blocks of an active file system in a storage system;

maintaining a set of snapshots in the storage system, each snapshot representing a state of said active file system at a particular point in time, each snapshot having a corresponding active map indicating in-use blocks and free blocks of the active file system for a point in time at which said snapshot was generated;

computing a summary map as a logical OR of the active maps of at least two of said snapshots, wherein said computing includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

identifying a set of snapshots created since a recent update of a selected portion of the summary map;

updating said selected portion of the summary map based on only a most recent one of said identified snapshots, and

using the summary map to make write allocation decisions in the storage system based on both a current active map of the active file system and said summary map, including using the summary map to avoid overwriting blocks used by a snapshot.

- **Claim 32 has been amended as:**

A method comprising:

maintaining an active map of information indicating in-use blocks and free blocks of an active file system;

maintaining a set of snapshots, each snapshot representing a state of said active file system at a particular point in time, each snapshot having a corresponding active map indicating in-use blocks and free blocks of the active file system for a point in time at which said snapshot was generated;

maintaining a summary map computed as a logical OR on active maps included in at least two of said snapshots, wherein said maintaining includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

identifying a set of snapshots created since a recent update of a selected portion of the summary map;

updating said selected portion of the summary map based on only a most recent one of said identified snapshots,

making a write allocation decision based on both a current active map of the active file system and the summary map, including using the summary map to avoid overwriting blocks used by a snapshot;

receiving a request to delete a particular snapshot; and

deleting said particular snapshot, wherein said deleting involves, for a block used by said particular snapshot, indicating said block is free in said summary map depending on a snapshot just prior to said particular snapshot and a snapshot just after said particular snapshot.

- **Cancel claim 41**
- **Claim 35 has been amended as:**

A method comprising:

maintaining an active map of information indicating in-use and free blocks associated with a file system;

maintaining a set of snapshots, each snapshot representing a state of said file system at a particular point in time;

maintaining a summary map computed as a logical OR of active maps included in at least two of said snapshots, wherein said maintaining includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

selecting a set of blocks maintained by said file system for which to perform a write allocation operation based on both a current active map of the file system and the summary map, including using the summary map to avoid overwriting blocks used by a snapshot;

identifying a set of snapshots created since a recent update of a selected portion of the summary map;

updating said selected portion of said summary map corresponding to said set of blocks, in response to said selecting; and

performing said write allocation operation in response to said updated summary map.

- **Claim 42 has been amended as:**

A method as in claim 35, wherein said logical union is an inclusive OR operation.

- **Cancel claims 46, 48**
- **Claim 43 has been amended as:**

A method comprising:

maintaining a plurality of persistent point-in-time images of a file system, each persistent point-in-time image representing a state of said file system at a particular point in time, each persistent point-in-time image having associated therewith a separate map indicating in-use blocks and free blocks of the file system at the corresponding point in time;

generating a summary map as a logical OR on at least two of said maps associated with the plurality of said persistent point-in-time images, wherein said generating includes performing a bitwise logical operation on at least two copies of said earlier maps associated with the plurality of persistent point in time images;

identifying a set of snapshots created since a recent update of a selected portion of the summary map;

updating said selected portion of the summary map based on only a most recent one of said identified snapshots; and

making write allocation decisions based on said summary map and a map indicating in-use blocks and free blocks associated with a current state of the file system, including using the summary map to avoid overwriting blocks used by a snapshot.

- **Claim 45 has been amended as:**

A method as in claim 43, wherein said summary map is computed using an inclusive OR operation.

- **Cancel claims 54, 55**
- **Claim 51 has been amended as:**

A method comprising:

maintaining a plurality of snapshots of a structured set of data in a data storage system, each snapshot representing a state of said structured set of data at a particular point in time, each snapshot having associated therewith a separate active map indicating in-use blocks and free blocks of the structured set of data at the corresponding point in time;

generating a summary map which represents a summary of at least two of said active maps for different points in time, by using a logical OR of said at least two of said active maps, wherein said generating comprises performing a bitwise logical operation on at least two copies of said earlier maps included in said plurality of snapshot;

identifying a set of snapshots created since a recent update of a selected portion of the summary map;

updating said selected portion of the summary map based on only a most recent one of said identified snapshots; and

making write allocation decisions relating to the structured set of data in the data storage system, based on the summary map and an active map indicating in-use blocks and free blocks associated with a current state of the structured set of data, including using the summary map to avoid overwriting blocks used by a snapshot.

Reasons for Allowance

4. Claims 25, 27, 30, 32-35, 40, 42, 43, 45, 51-53, are allowed, now renumbered as 1-14.

5. The following is a statement of reasons for the indication of allowable subject matter:

The present invention is directed to a system and method for creating a snapshot of a file system.

Claim 25 recites, or similarly recites, in combination with the remaining elements, a method comprising:

computing a summary map as a logical OR of the active maps of at least two of said snapshots, wherein said computing includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

using the summary map to make write allocation decisions in the storage system based on both a current active map of the active file system and said summary map, including using the summary map to avoid overwriting blocks used by a snapshot.

The closest prior art, Czajkowski et al. (U.S. Pat. No. 6,453,403), shows a substantially similar method for memory management using contiguous fixed-size blocks (Summary). Czajkowski discloses a series of snapshots in which the shaded blocks represent allocated or memory blocks, while the white blocks represent unallocated, each memory block has associated with it a status bit which indicates the current allocation status of that block (Fig. 3, col. 7, lines 18-38). Czajkowski teaches computing the summary map, but Czajkowski does not teach computing a summary map *as a logical OR of the active maps of at least two of said snapshots*. In complement, Lieuwen et al. (U.S. Pat. No. 6,272,502) discloses a system which keeps data consistent among the views and the database, despite the different times of refreshing undertaken. Lieuwen appears to suggest the logical OR of two of said snapshots but does not teach *computing includes performing a bitwise logical OR operation on at least two copies of earlier active maps included in said set of snapshots*, as specified in the amended claim. Further, Hits et al. (U.S. Pat. No. 5,819,292) discloses a method for maintaining consistent states of a file system and for creating user-accessible read-only copies of a file system. Hitz teaches using summary map to make write allocation decisions, but does not teach *the write allocation decisions based on both a current active map of the active file system and said summary map, which*

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computed as a logical OR. Therefore, Czajkowski, Lieuwen, and Hitz, singularly or in combination, still fail to anticipate or render the above cited limitations obvious.

Claim 32 recites, or similarly recites, in combination with the remaining elements, a method comprising:

maintaining a summary map computed as a logical OR on active maps included in at least two of said snapshots, wherein said maintaining includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

making a write allocation decision in the storage system based on both a current active map of the active file system and the summary map, including using the summary map to avoid overwriting blocks used by a snapshot.

The closest prior art, Czajkowski et al. (U.S. Pat. No. 6,453,403), shows a substantially similar method for memory management using contiguous fixed-size blocks (Summary). Czajkowski discloses a series of snapshots in which the shaded blocks represent allocated or memory blocks, while the white blocks represent unallocated, each memory block has associated with it a status bit which indicates the current allocation status of that block (Fig. 3, col. 7, lines 18-38). Czajkowski teaches computing the summary map, but Czajkowski does not teach maintaining a summary map *computed as a logical OR on active maps included in at least two of said snapshots*. In complement, Lieuwen et al. (U.S. Pat. No. 6,272,502) discloses a system which keeps data consistent among the views and the database, despite the different times of refreshing undertaken. Lieuwen appears to suggest the logical OR of two of

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said snapshots but does not teach *maintaining includes performing a bitwise logical OR operation on at least two copies of earlier active maps included in said set of snapshots*, as specified in the amended claim. Further, Hits et al. (U.S. Pat. No. 5,819,292) discloses a method for maintaining consistent states of a file system and for creating user-accessible read-only copies of a file system. Hitz teaches making a write allocation decision, but does not teach *the write allocation decision based on both a current active map of the active file system and said summary map, which computed as a logical OR*. Therefore, Czajkowski, Lieuwen, and Hitz, singularly or in combination, still fail to anticipate or render the above cited limitations obvious.

Claim 35 recites, or similarly recites, in combination with the remaining elements, a method comprising:

maintaining a summary map computed as a logical OR of active maps included in at least two of said snapshots, wherein said maintaining includes performing a bitwise logical operation on at least two copies of earlier active maps included in said set of snapshots;

selecting a set of blocks maintained by said file system for which to perform a write allocation operation based on both a current active map of the file system and the summary map, including using the summary map to avoid overwriting blocks used by a snapshot.

The closest prior art, Czajkowski et al. (U.S. Pat. No. 6,453,403), shows a substantially similar method for memory management using contiguous fixed-size blocks (Summary). Czajkowski discloses a series of snapshots in which the shaded blocks represent allocated or memory blocks, while the white blocks represent

unallocated, each memory block has associated with it a status bit which indicates the current allocation status of that block (Fig. 3, col. 7, lines 18-38). Czajkowski teaches computing the summary map, but Czajkowski does not teach a summary map *computed as a logical OR of active maps included in at least two of said snapshots*. In complement, Lieuwen et al. (U.S. Pat. No. 6,272,502) discloses a system which keeps data consistent among the views and the database, despite the different times of refreshing undertaken. Lieuwen appears to suggest the logical OR of two of said snapshots but does not teach *maintaining includes performing a bitwise logical OR operation on at least two copies of earlier active maps included in said set of snapshots*, as specified in the amended claim. Further, Hits et al. (U.S. Pat. No. 5,819,292) discloses a method for maintaining consistent states of a file system and for creating user-accessible read-only copies of a file system. Hitz teaches performing a write allocation but does not teach *the write allocation performs based on both a current active map of the active file system and said summary map, which computed as a logical OR*. Therefore, Czajkowski, Lieuwen, and Hitz, singularly or in combination, still fail to anticipate or render the above cited limitations obvious.

Claim 43 recites, or similarly recites, in combination with the remaining elements, a method comprising:

generating a summary map as a logical OR on at least two of said maps associated with the plurality of said persistent point-in-time images, wherein said generating includes performing

a bitwise logical operation on at least two copies of said earlier maps associated with the plurality of persistent point in time images;

making write allocation decisions based on said summary map and a map indicating in-use blocks and free blocks associated with a current state of the file system, including using the summary map to avoid overwriting blocks used by a snapshot.

The closest prior art, Czajkowski et al. (U.S. Pat. No. 6,453,403), shows a substantially similar method for memory management using contiguous fixed-size blocks (Summary). Czajkowski discloses a series of snapshots in which the shaded blocks represent allocated or memory blocks, while the white blocks represent unallocated, each memory block has associated with it a status bit which indicates the current allocation status of that block (Fig. 3, col. 7, lines 18-38). Czajkowski teaches generating a summary map, but Czajkowski does not teach generating a summary map as a logical OR on at least two of said maps associated with the plurality of said persistent point-in-time images. In complement, Lieuwen et al. (U.S. Pat. No. 6,272,502) discloses a system which keeps data consistent among the views and the database, despite the different times of refreshing undertaken. Lieuwen appears to suggest the logical OR of two of said snapshots but does not teach generating includes performing a bitwise logical OR operation on at least two copies of earlier active maps included in said set of snapshots, as specified in the amended claim. Further, Hits et al. (U.S. Pat. No. 5,819,292) discloses a method for maintaining consistent states of a file system and for creating user-accessible read-only copies of a file system. Hitz teaches making write allocation decisions, but does not teach the write allocation decisions based on both a current active map of the active file system and said summary map, which computed as

a logical OR. Therefore, Czajkowski, Lieuwen, and Hitz, singularly or in combination, still fail to anticipate or render the above cited limitations obvious.

Claim 51 recites, or similarly recites, in combination with the remaining elements, a method comprising:

generating a summary map which represents a summary of at least two of said active maps for different points in time, by using a logical OR of said at least two of said active maps, wherein said generating comprises performing a bitwise logical operation on at least two copies of said earlier maps included in said plurality of snapshot;

making write allocation decisions relating to the structured set of data in the data storage system, based on the summary map and an active map indicating in-use blocks and free blocks associated with a current state of the structured set of data, including using the summary map to avoid overwriting blocks used by a snapshot.

The closest prior art, Czajkowski et al. (U.S. Pat. No. 6,453,403), shows a substantially similar method for memory management using contiguous fixed-size blocks (Summary). Czajkowski discloses a series of snapshots in which the shaded blocks represent allocated or memory blocks, while the white blocks represent unallocated, each memory block has associated with it a status bit which indicates the current allocation status of that block (Fig. 3, col. 7, lines 18-38). Czajkowski teaches generating a summary map, but Czajkowski does not teach generating a summary map which represents a summary of at least two of said active maps for different points in time, by using a logical OR of said at least two of said active maps. In complement, Lieuwen et al. (U.S. Pat. No. 6,272,502) discloses a system which keeps data

consistent among the views and the database, despite the different times of refreshing undertaken. Lieuwen appears to suggest the logical OR of two of said snapshots but does not teach generating comprises performing a bitwise logical OR operation on at least two copies of earlier maps included in said set of snapshots, as specified in the amended claim. Further, Hits et al. (U.S. Pat. No. 5,819,292) discloses a method for maintaining consistent states of a file system and for creating user-accessible read-only copies of a file system. Hitz teaches making write allocation decisions, but does not teach the write allocation decisions based on both the summary map indicating in-use blocks and free blocks associated with a current state of the structured set of data, which computed as a logical OR. Therefore, Czajkowski, Lieuwen, and Hitz, singularly or in combination, still fail to anticipate or render the above cited limitations obvious.

6. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance".

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Miranda Le whose telephone number is (571) 272-4112. The examiner can normally be reached on Monday through Friday from 8:30 AM to 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Cottingham, can be reached on (571) 272-7079. The fax number to this Art Unit is (571)-273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (571) 272-2100.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Miranda Le/

Primary Examiner, Art Unit 2167